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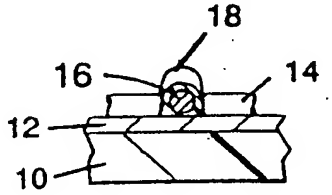
(54) Title: FILM REINFORCED WITH YARN COATED WITH HOT MELT ADHESIVE AND METHOD FOR PRODUCING THE SAME



(57) Abstract

The invention provides a reinforced film (10) or reinforced metallized film (12), in which the reinforcing yarns in the fill (6) and/or warp (14) direction are coated with hot melt adhesive (18) and placed in contact with the reinforced film, under heat and pressure, to melt the hot melt adhesive and bond the coated yarns to the film.

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FILM REINFORCED WITH YARN COATED WITH HOT MELT ADHESIVE AND METHOD FOR PRODUCING THE SAME

Technical Field Of The Invention

This invention relates generally to reinforced plastic films. In particular, the present invention relates to plastic films which use reinforcing fibers which are attached with hot melt adhesives.

Background Of The Invention

Thin, flexible plastic films, such as Polypropylene, polyethylene, polyvinyl chloride, Tedlar® (a registered trademark of E.I. DuPont De Nemours & Co. for polyvinyl fluoride films), Mylar® (a registered trademark of E.I. DuPont De Nemours & Co. for polyester films), and similar impermeable, nonporous plastic films, have been found to be particularly useful as moisture, vapor and thermal barriers for a variety of products such as aircraft insulation blankets. These properties, especially thermal reflectance and decreased moisture transmission through the film, can be improved by providing a thin, reflective metallized layer, typically on one side of the plastic film.

Such films, however, require reinforcement to enable them to withstand manufacturing and subsequent use. Reinforcement is generally provided by bonding reinforcing fibers to the film.

One way of providing a reinforced film is to cast the molten film plastic onto a scrim or reinforcing fibers so that the reinforcing fibers are carried within the film itself. This method is

disadvantageous, however, since it requires the manufacturer to acquire the equipment needed for casting and forming the various flexible plastic films and for metallizing if practical.

Another way of providing reinforced film is to select the desired pre-formed film or metallized film, and reinforce the film by adhesively bonding the reinforcing fibers or yarns to at least one side of the film.

Petroleum and organic based solvent adhesives have been widely used in the past to bond such reinforcing fibers to the film because of the speed of cure which is possible with such adhesives. However, the use of petroleum and organic based solvent adhesives is declining due to stricter air quality control laws. Further, solvent based adhesives may corrode aluminum, thus limiting the use of such reinforced films in aviation or in other environments in which aluminum is used. Thus, the need exists for a reinforced film in which the reinforcing yarns can be attached to the film using an adhesive which is non-corrosive and which produces low or no solvent emissions during cure.

Summary of the Invention

The present invention provides a reinforced metallized or non-metallized film in which the reinforcing yarns are attached using hot melt adhesives.

In one embodiment, the present invention provides a method for reinforcing a film with reinforcing fibers coated with hot-melt adhesive,

in which the yarns are placed in contact with the surface of the film and heat is applied to attach the yarns to the surface of the film.

In another embodiment, the present invention provides a film reinforced using hot melt coated yarns.

Brief Description of the Drawings:

A better understanding of the invention and its advantages will be apparent from the detailed description taken in conjunction with the accompanying drawings in which:

Figure 1 is a top view of a reinforced film of the present invention;

Figure 2 is a cross sectional view of a reinforced film of the present invention taken through line 2-2 of Figure 1;

Figure 3 is a cross-sectional view of a reinforced film of the present invention taken through line 3-3 of Figure 2; and,

Figure 4 is a simplified perspective diagram showing the bonding of reinforcing yarns to a film using hot nip rollers.

Detailed Description Of The Invention

Figures 1 and 2 show a basic configuration of a reinforced film of the present invention. Film 10 can be constructed of any thin, flexible, plastic film such as, for example, polypropylene, polyethylene, polyvinyl chloride, Tedlar®, Mylar® or the like. If desired, film 10 can include a thin metallized layer 12.

Reinforcing fibers, preferably including both fill fibers 16 and warp fibers 14, are coated with a hot melt type adhesive and bonded to the film 10 or metallized layer 12 by the subsequent application of heat and pressure. Hot melt adhesives are particularly desirable, since they generally do not emit gasses which are harmful to air quality, as solvent-based adhesives do, and because they are non-corrosive to aluminum.

Such reinforcing fibers can be constructed from synthetic or natural yarns, including nylon and cotton, and are preferably multifilament yarns. If synthetic yarns are used, a hot melt adhesive 18 must be selected which has a melting point lower than a temperature which will degrade either the yarn or the film.

A typical method for coating yarns with hot melt adhesive is set forth in U.S. Patent No. 4,774,135, the disclosure of which is incorporated herein by reference. For example, a 70 denier multifilament dacron thread can be coated with a polyamide hot melt adhesive such as Bostik 4252 to a thickness of about 0.0065 inches for use in reinforcing 0.2 to 0.5 mil plastic films.

In the reinforced film shown in Figures 1 and 2, the warp yarns 14 are preferably placed on the film first, followed by overlying fill yarns 16. Preferably the fill yarns 16 are precoated with hot melt adhesive, then positioned on the surface of the film 10 or metallized film 12 over warp yarns 14 which were previously laid onto the film, and heat and pressure sufficient to melt the adhesive is applied to

bond both the fill and warp yarns to the film, as shown in Figure 4. This is done by drawing the desired number of hot melt coated fill yarns 16, 16' off spools 22, 22' which are spaced apart as desired along bracket 20. Bracket 20 preferably includes a device for maintaining the desired tension on the yarns 16, 16' as they pass from the spools 22, 22' to the film 10 on which the warp yarns 14, 14' have been laid. The yarns 16, 16', 14 and film pass between hot nip rollers 26, 26' which melt the hot melt adhesive 18 coating the yarns 16, 16' and press the coated yarns against the warp yarns 14, 14' and the film 10. As the reinforced film 28 passes out from between the hot nip rollers 26, 26', the hot melt adhesive 18 cools and hardens, bonding both the warp yarns 14 and the fill yarns 16 to the film surface. In some cases the reinforcing warp yarns 14 may also be coated with adhesive.

One skilled in the art will recognize that while the preferred embodiments have been described in detail, and shown in the accompanying drawings, one skilled in the art will recognize that various further modifications are possible without departing from the scope of the invention as set forth in the appended claims.

CLAIMS

I claim:

1. A reinforced film comprising:

a film substrate;

a plurality of regularly spaced reinforcing yarns bonded to said film substrate with a hot melt adhesive.

2. The film of claim 1 in which the reinforcing yarns include a plurality of yarns regularly spaced in a fill direction and a plurality of yarns regularly spaced in a warp direction.

3. The film of claim 2 in which said reinforcing yarns are bonded one side of the film substrate.

4. The film of claim 3 in which the film substrate additionally comprises a metallized layer bonded to one side of the film substrate.

5. The film of claim 4 in which the reinforcing yarns are bonded to the metallized layer.

6. The film of claim 1 in which the reinforcing yarns are multifilament, synthetic yarns.

7. The film of claim 2 in which the fill reinforcing yarns are laid over the warp reinforcing yarns.

8. The film of claim 7 in which the fill yarns are coated with hot melt adhesive, the warp reinforcing yarns are not coated with adhesive, and the fill and warp yarns are bonded to the film by the hot melt adhesive coating the fill yarns.

9. A method for producing a reinforced film in which reinforcing yarns are bonded to the film with hot melt adhesive, said method comprising:

a. Coating a first reinforcing yarn with a hot melt adhesive;

b. Positioning the first reinforcing yarn on a surface of the film;

c. Applying heat and pressure to melt the hot melt adhesive and to bond the coated yarn to the surface of the film; and

d. Cooling the film.

10. The method of claim 9 in which reinforcing yarns are spaced apart and laid down in a warp direction and a fill direction.

11. The method of claim 10 in which the warp yarns are laid down on the surface of the film first, and are overlaid by the fill yarns.

12. The method of claim 11 in which the fill yarns are first reinforcing yarns, and the warp yarns are not coated with adhesive.

13. The method of claim 9 in which the film has a metallized coating on one side, and in which the reinforcing yarns are bonded to the metallized side of the film.

14. A method for producing a reinforced film in which reinforcing yarns are applied in a warp direction and in a fill direction and bonded to the film with hot melt adhesive, said method comprising the steps of:

a. Coating the fill yarns with a hot melt adhesive;

b. Positioning the warp yarns on a first surface of the film, and overlaying with the coated fill yarns;

c. Applying heat and pressure to melt the hot melt adhesive and to press the yarns onto the first surface of the film; and,

d. Cooling the film.

15. The method of claim 14 in which the film also includes a metallized coating on its first side, and in which the reinforcing fibers are bonded to the metallized coating.

16. The method of claim 14 in which the warp yarns are also coated with hot melt adhesive.

17. The method of claim 14 in which the reinforcing yarns positioned in the warp direction are substantially parallel to and regularly spaced away from each other.

18. The method of claim 17 in which the reinforcing yarns positioned in the fill direction are substantially parallel to and regularly spaced away from each other, and substantially perpendicular to the reinforcing yarns positioned in the warp direction.

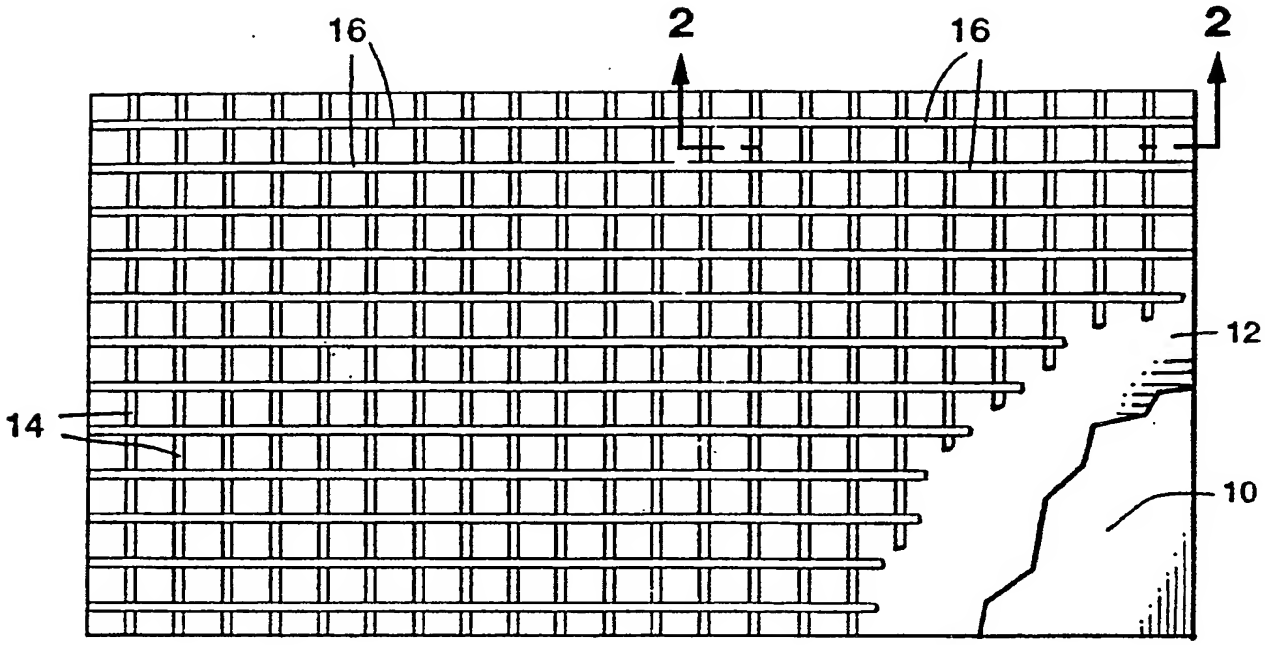

FIG. 1

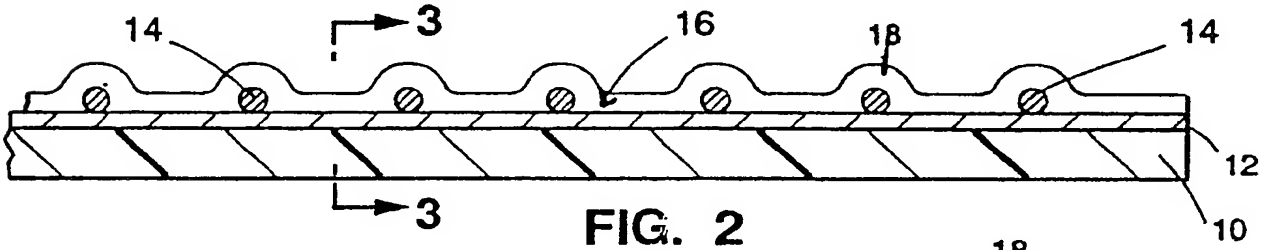

FIG. 2

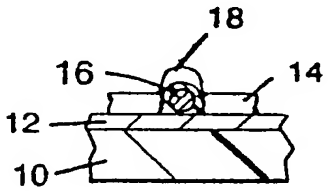

FIG. 3

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US92/07555

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :B32B 7/14, 31/12
US CL :156/279, 176; 428/252, 255, 257, 261, 288, 344
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 156/279, 176; 428/252, 255, 257, 261, 288, 344

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 3,565,741 (JARAY) 23 FEBRUARY 1971 See col. 3, lines 1-11.	1-18
Y	US, A, 4,147,580 (BUELL) 03 APRIL 1979 See entire document.	1-18
Y	US, A, 4,774,135 (BRYANT) 27 SEPTEMBER 1988 See entire document.	1-18

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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